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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/853,323
Filing Date: May 10, 2001
Appellant(s): HOSHIDA ET AL.

Brian Oaks
For Appellant

EXAMINER'S ANSWER

MAILED
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This is in response to the appeal brief filed 10/19/06 appealing from the Office action mailed 7/7/06.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US-6,556,327	OHYA et al	4-2003
US-6,417,958 B1	DU et al	7-2002
US-6,310,709 B1	BERGANO	10-2001

US-5,515,196	KITAJIMA et al	5-1996

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-6, 8-9, 11-18, 20-21, 23-24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitajima (U.S. Patent No. 5,515,196) in view of Du (U.S. Patent No. 6,417,958).

Regarding claim 1, 13, 23, and 26, Kitajima teaches modulating a non-intensity characteristic of an optical carrier signal with a data signal (reference numeral 13-10a in Figure 32) to generate an optical information signal; transmitting the optical information signal over an optical link (e.g. output of phase modulator 13-10b in Figure 32), and amplifying the optical information signal over a length of the optical link (reference numeral 102 in Figure 11). Kitajima differs from the claimed invention in that Kitajima fails to specifically teach that the optical information signal is amplified with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link. However, Du, in the same field of optical communication, teaches that it is well known in the art to amplify an optical

information signal over a length of an optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link (see abstract). One skilled in the art would have been motivated to amplify an optical information signal over a length of an optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link in order to provide for a reduction of signal-pump-signal cross talk (column 3 lines 31-37). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to amplify an optical information signal over a length of an optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link as taught by Du in the system of Kitajima.

Regarding claim 2 and 14, the combination of Kitajima and Du teaches that the co-launched amplification signal travels at a substantially same speed as the optical information signal (e.g. both signals being light signals, they each travel near the speed of light).

Regarding claim 3 and 15, the combination of Kitajima and Du teaches that the co-launched amplification signal comprises a wavelength lower than that of the optical information signal (column 7 lines 32-34 of Du).

Regarding claim 4 and 16, the combination of Kitajima and Du teaches that the optical information signal is amplified over the length of the optical link with the co-launched amplification signal by distributed Raman amplification (DRA) (as noted in the abstract and seen in Figure 4 of Du).

Regarding claim 5 and 17, the combination of Kitajima and Du teaches generating a plurality of optical information signals (reference numeral 110 in Figure 11 of Kitajima) each comprising a wavelength distinct carrier signal having the non-intensity characteristic modulated

with a data signal (reference numeral 13-10a in Figure 32 of Kitajima), multiplexing the plurality of optical information signals to generate a wavelength division multiplexed (WDM) signal (reference numeral 112 in Figure 11 of Kitajima) , transmitting the WDM signal over the optical link (reference numeral 101 in Figure 11 of Kitajima); and amplifying the WDM signal over the length of the optical link (reference numeral 102 in Figure 11 of Kitajima) with a plurality of co-launched amplification signals transmitted in the same direction as the WDM signal (see abstract of Du).

Regarding claim 6, 18, and 24, the combination of Kitajima and Du teaches that the phase of the optical carrier is modulated with the data signal (reference numeral 13-10a in Figure 32 of Kitajima).

Regarding claim 8 and 20, the combination of Kitajima and Du teaches further amplifying the optical information signal over a second length of the optical link with a counter-launched amplification signal traveling in an opposite direction as the optical information signal and the co-launched amplification signal (Figure 13 if Du).

Regarding claim 9 and 21, the combination of Kitajima and Du teaches that the optical information signal and the co-launched amplification signal travel in the first direction, further comprising: modulating the non-intensity characteristic of a second optical carrier signal with a second data signal to generate a second optical information signal (reference numeral 13-10a in Figure 32 of Kitajima; reference numeral 320 in Figure 12 of Du); transmitting the second optical information signal over the optical link in a second direction opposite the first direction (Figure 12 of Du); and amplifying the first and second optical information signals over the length of the optical link with the co-launched amplification signal and a counter-launched

amplification signal traveling in the second direction (reference numeral 240, 400 in Figure 12 of Du).

Regarding claim 11, the combination of Kitajima and Du teaches further amplifying the signal in the optical link with a discrete amplifier (reference numeral 102 in Figure 11 of Kitajima; reference numeral 220 in Figure 12 of Du).

Regarding claim 12, the combination of Kitajima and Du teaches that the discrete amplifying comprises an erbium-doped fiber amplifier (reference numeral 220 in Figure 12 of Du).

3. Claims 7, 10, 19, 22, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitajima in view of Du, and further in view of Ohya (U.S. Patent No. 6,556,327).

Regarding claim 7, 19, and 25, the combination of Kitajima and Du differs from the claimed invention in that it fails to specifically teach that the frequency of the optical carrier signal is modulated with the data signal. However, Ohya, in the same field of optical transmitters, teaches that this concept is well known in the art (Figure 7). One skilled in the art would have been motivated to modulate the frequency of the optical carrier signal with a data signal in order to allow a simpler configuration and to reduce the power consumption in comparison to the phase modulation setup of Kitajima (column 10 lines 19-25 of Ohya). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modulate the frequency of the optical carrier signal with a data signal as taught by Ohya in the system of the combination of Kitajima and Du.

Regarding claim 10 and 22, the combination of Kitajima, Du, and Ohya teaches remodulating the optical information signal with a transmission clock frequency using an

intensity modulator (reference numeral 30 in Figure 7 in Ohya) to generate a multimodulated signal, transmitting the multimodulated signal over the optical link (reference numeral 101 in Figure 11 of Kitajima); and amplifying the multimodulated signal over the length of the optical link (reference numeral 102 in Figure 11 of Kitajima) with the co-launched amplification signal traveling in the same direction as the multimodulated signal (abstract of Du).

4. Claims 1-5, 7-9, 11-17, 19-21, 23, and 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergano (U.S. Patent No. 6,310,709) in view of Du (U.S. Patent No. 6,417,958).

Regarding claim 1, 13, 23, and 26, Bergano teaches modulating a non-intensity characteristic of an optical carrier signal with a data signal (reference numeral 102 in Figure 1) to generate an optical information signal; transmitting the optical information signal over an optical link (e.g. output of phase modulator 108 in Figure 1). Bergano differs from the claimed invention in that Bergano fails to specifically teach amplifying the optical information signal over a length of the optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link. However, Du, in the same field of optical communication, teaches that it is well known in the art to amplify an optical information signal over a length of an optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link (see abstract). One skilled in the art would have been motivated to amplify an optical information signal over a length of an optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link in order to provide for a reduction of signal-pump-signal cross talk (column 3 lines 31-37). Therefore, it would have been obvious to one skilled in the art

at the time the invention was made to amplify an optical information signal over a length of an optical link with a co-launched amplification signal traveling in a same direction as the optical information signal in the optical link as taught by Du in the system of Bergano.

Regarding claim 2 and 14, the combination of Bergano and Du teaches that the co-launched amplification signal travels at a substantially same speed as the optical information signal (e.g. both signals being light signals, they each travel at the speed of light).

Regarding claim 3 and 15, the combination of Bergano and Du teaches that the co-launched amplification signal comprises a wavelength lower than that of the optical information signal (column 7 lines 32-34 of Du).

Regarding claim 4 and 16, the combination of Bergano and Du teaches that the optical information signal is amplified over the length of the optical link with the co-launched amplification signal by distributed Raman amplification (DRA) (as noted in the abstract and seen in Figure 4 of Du).

Regarding claim 5 and 17, the combination of Bergano and Du teaches generating a plurality of optical information signals (reference numeral 120 in Figure 12 of Du) each comprising a wavelength distinct carrier signal having the non-intensity characteristic modulated with a data signal (reference numeral 102 in Figure 1 of Bergano), multiplexing the plurality of optical information signals to generate a wavelength division multiplexed (WDM) signal (reference numeral 140 in Figure 12 of Du) , transmitting the WDM signal over the optical link (reference numeral 160 in Figure 1 of Du); and amplifying the WDM signal over the length of the optical link (reference numeral 220 in Figure 12 of Du) with a plurality of co-launched amplification signals transmitted in the same direction as the WDM signal (see abstract of Du).

Regarding claim 7, 19, and 25, the combination of Bergano and Du teaches that the frequency of the optical carrier signal is modulated with the data signal (reference numeral 102, 104, 106 in Figure 1 of Bergano).

Regarding claim 8 and 20, the combination of Bergano and Du teaches further amplifying the optical information signal over a second length of the optical link with a counter-launched amplification signal traveling in an opposite direction as the optical information signal and the co-launched amplification signal (Figure 13 if Du).

Regarding claim 9 and 21, the combination of Bergano and Du teaches that the optical information signal and the co-launched amplification signal travel in the first direction, further comprising: modulating the non-intensity characteristic of a second optical carrier signal with a second data signal to generate a second optical information signal (reference numeral 102 in Figure 1 of Bergano; reference numeral 320 in Figure 12 of Du); transmitting the second optical information signal over the optical link in a second direction opposite the first direction (Figure 12 of Du); and amplifying the first and second optical information signals over the length of the optical link with the co-launched amplification signal and a counter-launched amplification signal traveling in the second direction (reference numeral 240, 400 in Figure 12 of Du).

Regarding claim 11, the combination of Bergano and Du teaches further amplifying the signal in the optical link with a discrete amplifier (reference numeral 102 in Figure 11 of Bergano; reference numeral 220 in Figure 12 of Du).

Regarding claim 12, the combination of Bergano and Du teaches that the discrete amplifying comprises an erbium-doped fiber amplifier (reference numeral 220 in Figure 12 of Du).

5. Claims 6, 10, 18, 22, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergano in view of Du, and further in view of Ohya (U.S. Patent No. 6,556,327).

Regarding claim 6, 18, and 24, the combination of Bergano and Du differs from the claimed invention in that it fails to specifically teach that the phase of the optical carrier signal is modulated with the data signal. However, Ohya, in the same field of optical transmitters, teaches that this concept is well known in the art (Figure 7). One skilled in the art would have been motivated to modulate the phase of the optical carrier signal with a data signal in order to allow excellent carrier to noise ratio (column 3 lines 6-14 of Ohya). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modulate the phase of the optical carrier signal with a data signal as taught by Ohya in the system of the combination of Bergano and Du.

Regarding claim 10 and 22, the combination of Bergano and Du teaches transmitting the multimodulated signal over the optical link (reference numeral 101 in Figure 11 of Bergano); and amplifying the multimodulated signal over the length of the optical link (reference numeral 102 in Figure 11 of Bergano) with the co-launched amplification signal traveling in the same direction as the multimodulated signal (abstract of Du), but differs from the claimed invention in that it fails to specifically teach remodulating the optical information signal with a transmission clock frequency using an intensity modulator to generate a multimodulated signal. However, Ohya teaches remodulating the optical information signal with a transmission clock frequency using an intensity modulator (reference numeral 30 in Figure 7 in Ohya) to generate a multimodulated signal. One skilled in the art would have been motivated to do so in order to stabilize the intensity of the transmitted light signal. Therefore, it would have been obvious to

one skilled in the art at the time the invention was made to remodulate the optical information signal with a transmission clock frequency using an intensity modulator to generate a multimodulated signal.

(10) Response to Argument

The Appellant agues that Du fails to provide motivation to one skill in the art to adopt a copropagating-pump optical amplifier in the system of Kitajima. The Appellant supports this assertion by noting that Du discloses that the copropagating-pump Raman optical amplifier increases cross-talk. However, the examiner notes that Du makes this disclosure as a statement of the current state of the art and then goes on to show that the use of copropagating-pump Raman optical amplifiers are not only feasible, but have advanced to the point that they are essentially problem free " (column 3 lines 60-64 of Du), and could prove advantageous in today's high capacity-long distance communication systems (column 3 lines 17-24 of Du) .

The fact is that Kitajima, as noted in the office action, discloses the use of optical amplifiers in a communication system (reference numeral 102 in Figure 11 of Kitajima), but fails to provide the details of the type of optical amplifier used. In doing so, Kitajima has left door open to interpretation by one skill in the art to use one or more of the variety of different optical amplifiers available today including Raman amplifiers with a co-propagating pump signal. Du discloses such co-propagating pump Raman optical amplifiers which "essentially eliminate problems associated with the SPS crosstalk in a co-propagating Raman amplifier" (column 3 lines 60-64 of Du). Du further discloses that these state of the art co-propagating pump Raman amplifiers are compatible with virtually any wavelength division multiplexed optical communication system (column 3 lines 39-40 of Du).

Therefore the examiner, contrary to Appellant's assertion, contends that one skill in the art would indeed have been motivated to employ Du's copropagating-pump Raman optical amplifiers given Du's disclosure of an essentially problem free optical amplifier, Kitajima's call for the use of an optical amplifier, the assured compatibility of Du's co-propagating pump Raman amplifiers with Kitajima's wavelength division multiplexed optical communication system, and Du's disclosure of additional benefits in using co-propagating Raman amplifiers.

Next, the applicant argues that Du fails to specifically teach modulating a non-intensity characteristic of an optical signal with a data signal reduces cross talk when using a co-propagating Raman amplifier. However, the record clearly shows that the examiner has relied on Kitajima for the disclosure of this limitation in the Appellant's claim and has never implied that Du teaches this limitation nor cited a portion of Du to meet this limitation. Rather, the examiner has relied on Du only for the disclosure of a co-propagating pump Raman optical amplifier.

It is apparent that the Appellant is intent on attacking the examiner's stated reasoning as to why one skill in the art would have been motivated to employ Du's copropagating-pump Raman optical amplifiers in Kitajima by arguing in a round-about way that the combination of Du with Kitajima would not produce the same cross-talk reduction noted in Du and cited by the examiner as motivation for combining Kitajima and Du. However, as noted above Du provides many other motivating factors for employing copropagating-pump Raman optical amplifiers in a system like that of Kitajima, while Kitajima teaches but purposefully fails to limit the type of optical amplifiers used in the system.

Furthermore, it is important to keep in mind that the systems of Du and Kitajima are completely separate and there is nothing preventing one skill in the art from following the steps

that Du discloses as necessary to producing an essentially problem free copropagating-pump Raman optical amplifier. In other words, once Du's copropagating-pump Raman optical amplifiers are used as the optical amplifiers called for by Kitajima, you could apply each of the steps called for by Du to produce the essentially problem free copropagating-pump Raman optical amplifier without destroying the functionality of either Kitajima's or Du's system. Kitajima's system would still modulate a non-intensity characteristic of an optical carrier signal, transmit that signal, and amplify that signal, but would now amplify it with Du's essentially problem free copropagating-pump Raman optical amplifier – a regular copropagating-pump Raman optical amplifier that became problem free not by changing anything that Kitajima's system is set to do or has already done, but at a minimum by transmission of a sufficient number of independent channels, and by encoding the data so that any given channel has a small ratio of integrated RIN values over the fiber crosstalk bandwidth to that over the entire signal electrical bandwidth (column 3 lines 49-64 of Du).

Next, the applicant argues the combination of Du and Kitajima fails to specifically teach that the co-launched amplification signal travels at ***substantially*** the same speed as the optical information signal. However, there being no recited difference in the co-launched amplification signal apparatus of the claimed invention and that of Du, the examiner believes that both the system of Du and that of the claimed invention operate in the same manner in introducing a co-launched amplification signal into a fiber. As such, the examiner asserts that the speed at which the co-launched amplification signal travels in the system of Du like that of the claimed invention must be at substantially the same speed as the optical information signal. As noted above, the claim language fails to positively recite any feature of the Appellant's co-launched

amplification signal that distinguishes it from Du's co-launched amplification signal. Given no physical difference between the Appellant's co-launched amplification signal and Du's co-launched amplification signal, it stands to argue that both co-launched amplification signals act the same in an optical medium and travel at substantially the same speed as the optical information signal they are copropagating with. While the Appellant's argument that the speed at which light travels in an optical transmission medium varies according to its wavelength is 100% true, the applicant fails to recite any limitation regarding the wavelength of the co-launched amplification signal that would distinguish it from the co-launched amplification signal of Du. Rather, by this argument the Appellant simply implies that the co-launched amplification signal and the optical information signal are at the same wavelength, as must be so for the two signals to co-propagate at almost the exact same speed. Therefore, there being no physical difference between the co-launched amplification signal producing apparatus of Du and that of the claimed invention and no positive distinguishing recitation regarding the wavelength of the claimed co-launched amplification signal, the examiner has concluded that the co-launched amplification signal of both Du and the claimed invention must travel at substantially the same speed as that of the optical information signal.

The applicant further argues that the combination of Du and Kitajima fails to specifically teach the further amplification of the optical signal with a subsequent discrete amplifier. However, as noted by the Appellant, Kitajima and Du teach these limitations individually. As such, the examiner believes that once the combination of Kitajima and Du is made as in claim 1, the combination of references meet the limitations of the claimed invention with motivation for combining the references already provided in the rejection of claim 1.

The Appellant finally argues that the combination of Kitajima, Du and Ohya is improper since they depend from claims 1, 13, and 23 that were rejected over the combination of Kitajima and Du above. However, as stated above the examiner believes that the base combination of Kitajima and Du is proper and therefore, lacking any evidence to the contrary, the combination of Kitajima, Du and Ohya is also proper.

Moving on to the Appellant's next set of arguments, the Appellant begins by arguing against the combination of Bergano and Du due to the apparent lack of disclosure in the combination for modulating a non-intensity characteristic of an optical carrier signal with a data signal to generate an optical information signal. However, as clearly stated in Bergano and noted by the Appellant, the modulator modulates the optical signal at a frequency dictated by the frequency the clock signal. The examiner believes that this dictation of when or at what frequency information may be modulated onto the carrier presents what can be considered a frequency modulation of the optical carrier when the Appellant's claimed frequency modulation is given the broadest reasonable interpretation. Moreover, the Appellant's assertion that Bergano's clock operates a single frequency is unfounded since Bergano gives no indication that this is so and merely discloses that clock operates at some frequency, not necessarily a single frequency.

Furthermore, Bergano disclosure works against Appellant's argument that Bergano suggests intensity or amplitude modulation as the disclosed "conventional modulation" scheme. First, as noted above, Bergano clearly discloses frequency modulation, and second frequency modulation (FM) is more "conventional" or the norm today than intensity or amplitude modulation (AM). For the Appellant to argue that frequency modulation or FM is not the

preeminent conventional modulation scheme today borders on absurd given that anyone from one skilled in the art to a layperson off the street will recognize FM as being omnipresent, or at the very least just as conventional or commonplace as AM. Granted, this recognition of FM is due to the pervasiveness of radio, but FM is absolutely conventional nonetheless.

The balance of the Appellant's arguments repeats arguments that have been rebutted above.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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